

Terahertz Science and Technology of Carbon Nanomaterials

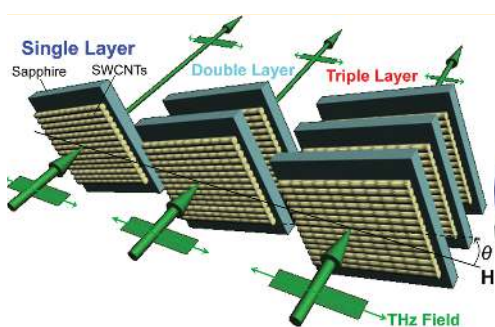
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The diverse applications of terahertz (THz) radiation and its importance to fundamental condensed matter science makes finding ways to generate, manipulate, and detect THz radiation one of the key areas of modern applied physics. However, despite decades of worldwide efforts, the THz region of the electromagnetic spectrum still continues to be elusive for solid-state technology.

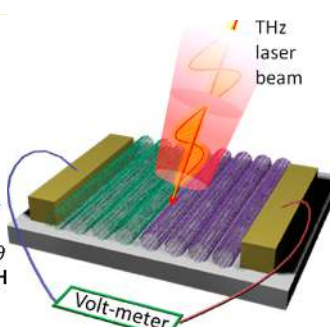
Recently, there has been a growing recognition that carbon nanomaterials – i.e., graphene and carbon nanotubes (CNTs) – have some outstanding electronic and photonic properties that are ideally suited for THz devices [1].

In this talk, after reviewing the past, current, and future of the THz science and technology of graphene and carbon nanotubes, we will present some of our latest results on THz dynamic conductivity and ultrafast carrier dynamic as well as THz devices including polarizers, modulators, and detectors.



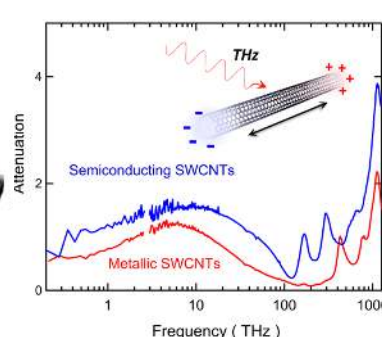
CNT THz polarizers

Nano Lett. **9**, 2610 (2009); **12**, 787 (2012)



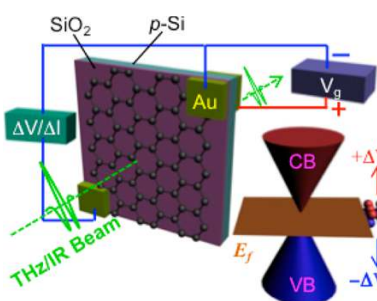
CNT THz detector

Nano Lett. **14**, 3953 (2014)



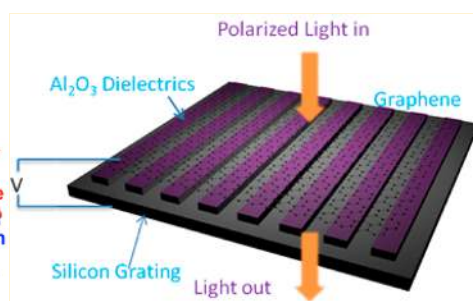
THz plasmons in CNTs

Nano Lett. **13**, 5991 (2013)



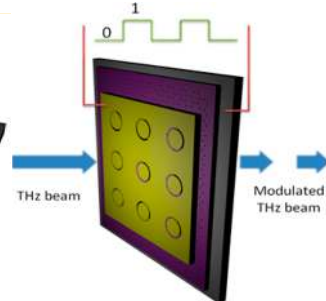
THz dynamics in gated graphene

Nano Lett. **12**, 3711 (2012)



THz surface plasmon-polaritons in gated graphene

Nano Lett. **13**, 3698 (2013)



THz modulation with graphene/EOT

Nano Lett. **14**, 1242 (2014)

1. R. R. Hartmann, J. Kono, and M. E. Portnoi, "Terahertz Science and Technology of Carbon Nanomaterials," *Nanotechnology* **25**, 322001 (2014).